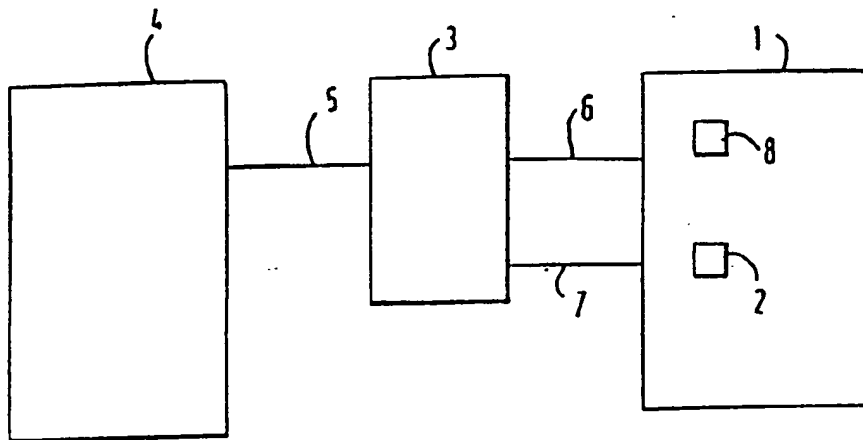


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(54) Title: CELLULAR TELEPHONE APPARATUS AND CELLULAR COMMUNICATION SYSTEM



(57) Abstract

A supplementary unit for portable energy reduction embodies a low energy consumption VHF radio paging receiver (4) normally switched on, which is used to "Wake Up" a Portable Duplex UHF cellular radio telephone apparatus (1) (normally off) in response to a specific coded VHF radio transmitted signal initiated by a modified cellular network's Electronic Mobile exchange on receipt of an incoming call, which after a brief predetermined time delay then transmits the current standard coded UHF paging/control signals, followed by the standard UHF duplex signalling sequences used to set up a call.

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Cellular Telephone Apparatus and Cellular Communication System

DESCRIPTION OF INVENTION

Improvements in or relating to cellular telephone apparatus and a cellular communication system.

THE PRESENT INVENTION relates to a cellular telephone apparatus and a cellular communication system. More particularly the invention relates to a transportable or hand held portable cellular telephone apparatus, and a cellular communication system for use with such apparatus.

During recent years in developed countries extensive national public duplex UHF mobile radio telecommunication networks have been established. Known typically by names such as TACS - Total Access Communication System - used in Britain, AMPS - Advanced Mobile Phone System - used in USA, NMT - Nordic Mobile Telephones - used in the Nordic Countries, and NAMTS - used in Japan (not to speak of the proposed Pan-European Digital Cellular Radio Network), the systems enable one to make or receive telephone calls from a phone in a vehicle, brief case or pocket, to any other telephone in the world, which works almost as conveniently as a home or office phone.

The networks, which are also known as "Cellular Communications", divide the area of a country into smaller areas called "cells". Each cell is served by a radio transmitting and receiving station known as a "base station", the range of which overlaps adjacent cells. Utilizing specially dedicated UHF radio channels (of typically 25 KHz separation and 45 MHz duplex spacing) in the frequency bands of typically 890 - 915 MHz (for transmitting) and 935 - 960 MHz (for receiving), each cellphone (also known as a "mobile") is in communication with the cell area base station which in turn is (landline and/or microwave) linked back to a central computer controlled electronic "Mobile Switching Centre" (MSC) also known as an "Electronic Mobile Exchange" (EMX). The Electronic Mobile Exchange provides the necessary telecommunication link with other mobiles in the same and other cells, and also with the public national and international switched telephone network.

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As cellphone users move from one cell area to another, the system automatically switches control of the call from the cell they are leaving to the cell they are entering. The process known as "Hand Off" enables the cellphone users to continue their calls uninterrupted while moving around the country. The Computer Controlled Electronic Mobile Exchange is provided with complicated software to monitor and control the whole system.

At present, to scan the broad band frequency spectrum of Cellular Radio, and to Register, Monitor and Respond to EMX control commands each cellphone apparatus is provided with monitoring electronic apparatus including typically:-

- a Duplexer Unit
- a Synthesizer
- a Universal Asynchronous Receiver/Tranxmitter (UART)
- a Decoder/Encoder Unit
- an Analogue to Digital Converter
- a Watchdog Circuit
- an Audio Path Circuit

all of which must be active or energized in the "Idle Mode", or "sleep mode" (the condition in which a cellphone apparatus has registered its identity/presence and is ready to receive calls, but is neither being paged, nor making, nor receiving a telephone call).

The big drawback or disadvantage of present cellphone apparatus/Cellular Systems is that in this Sleep Mode the electric current consumption (of the monitoring apparatus) is significantly high (typically 80 - 175 milliamps), largely because at the Ultra High Frequency bands used, technology does not yet exist to manufacture low power, micro-chip integrated circuitry - (current microchip technology at these high frequencies makes use of bipolar chips which still have a high current/energy consumption). This disadvantage is further aggravated by command signals from the EMX requiring mobiles to transmit periodically to register and reregister their presence, identification and cell area location.

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In the case of hand held portables, this heavy energy consumption constitutes a major problem, resulting in a very limited battery life (typically 3 - 5 hours) after which the subscriber is disconnected and not contactable. Even with this limited battery life, present day hand held portables still have to carry large battery packs, which makes them heavy and bulky. In the case of car cellphones the high energy consumption of the cellphone is sufficient to cause the vehicle battery to go flat if left on overnight; and in an endeavour to overcome this problem, car cellphone manufacturers have had to resort to providing special automatic circuits to "switch off" the cellphone after a pre-determined period (typically 4 hours).

By contrast also during recent years VHF Digital Radio Paging Networks have been established enabling a Radio Pager User to be alerted from any Telephone with access to the Public Telephone Network. By directly dialling the users Radio Paging Number (typically without charge); one is connected to an unmanned automatic Computer Controlled Radio Paging Centre which is (landline and/or micro-wave) linked to Transmitting Stations covering most of the Country. Radio Pagers are typically small and light and have a long battery life. This is largely because they receive and operate on lower radio frequencies - the VHF band (typically 138 - 174 MHz), enabling lower current consumption and/or the use of CMOS micro-chip transistorized circuitry. Battery energy conservation is also enhanced by micro-chip clock circuits which provide frequent periodic cyclic switching "On" and "Off" of the radio pager receiver. The "Off" period is typically substantially longer than the "On" period. However for the purpose of this invention, this cyclic feature preferably need not be utilized.

The object of the present invention is to overcome this heavy energy consumption/short battery life disadvantage of present cellphone systems/apparatus in the sleep mode, by providing a "Supplementary Unit for Portable Energy Reduction", conveniently known as - "SUPER", together with corresponding modifications and additions to the system Cellular Network Software and Hardware in order to operate the "SUPER" "Long Sleep Life" facility advantageously without affecting existing cellular telephone subscribers who do not wish to avail themselves of the "SUPER" Long Sleep Life facility. Thus the present systems, known as TACS, AMPS, NMT, and NAMTS would be upgraded and for convenience be known as SUPERTACS, SUPERAMPS, SUPERNMT, and SUPERNAMTS.

A further spin-off object of this invention is that by providing embodiments where in its battery energy is so significantly conserved it is feasible to design portable cellphone units with smaller battery packs and hence smaller and lighter overall sizes.

According to this invention there is provided a cellular telephone apparatus, said apparatus comprising means to establish connection with and receive electric power from a battery, electronic circuits driven by said electric power adapted to receive, monitor, process and transmit signals, there being a normally open controlled relay switch between said means to establish a connection with a battery and said electronic circuits, and means to close said relay switch in response to a specific radio transmitted signal in order to activate said electronic circuits.

Preferably said means to activate the relay switch comprise a radio receiver adapted to receive a digitally coded radio signal of a predetermined frequency, and decoder circuit adapted to decode the signal and to respond to a specific digitally coded signal.

Conveniently, the radio receiver is adapted to receive a radio signal having a frequency typically between 138 MHz and 174MHz.

Advantageously the radio receiver is adapted to receive a radio signal of a predetermined frequency having a bandwidth of typically 25 KHz.

Preferably said radio signal has a frequency of typically 150MHz.

Conveniently means are provided which, when said relay switch has been closed in response to said specific radio transmitted signal, maintain the relay switch in the closed condition at least until a predetermined time has elapsed.

Preferably the means to operate the relay switch are such that the relay switch is maintained closed until a predetermined signal is provided.

Conveniently said means provided to generate said predetermined signal are adapted to be deactivated at the termination of a call received by the apparatus.

Preferably the means to activate the normally off relay switch comprise a latching circuit adapted to be latched in a predetermined condition in response to said specific transmitted signal.

Conveniently said latching circuit incorporates a relay adapted to be closed in response to said specific transmitted signal, the relay closing a current path which maintains the relay in a closed condition, said current path incorporating a closed second relay, said closed second relay being adapted to open in response to said predetermined signal to release the latching circuit.

Advantageously said latching circuit incorporates an OR gate adapted to be provided with a pulse in response to said specific transmitted signal, the output of the OR gate being connected to one input of a NAND gate, the output of the NAND gate being connected to the other input of the OR gate, the output of the OR gate being connected to a switching arrangement adapted to activate the normally inactive receiver and transmitter, a lead being connected to the other input of the NAND gate adapted to provide a said predetermined signal to the NAND gate when it is desired to deactivate the high frequency receiver.

The invention also relates to a cellular telecommunication system comprising a plurality of cellular telephones in accordance with the invention and a plurality of base stations, each base station comprising means to transmit signals to and receive signals from the said electronic circuits of the cellular telephone, the system further including means to transmit said specific radio signals to the cellular telephones.

Preferably each base station is provided with means to transmit said specific radio signals.

Conveniently the system comprises a mobile switching centre and/or an electronic mobile exchange adapted to control the transmission of said specific signals and being adapted to control the transmission of additional signals to the said electronic circuits of a cellular telephone, the arrangement being such that the predetermined signal is transmitted a predetermined period of time before said additional signals to said electronic circuits are transmitted.

Advantageously the means to transmit said specific signals transmit the signals at a frequency typically between 138 MHz and 174 MHz.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described by way of example with reference to the accompanying drawings in which:

FIGURE 1 is a block circuit diagram of a cellular telephone in accordance with the invention;

FIGURE 2 illustrates a switching circuit that forms part of the embodiment of Figure 1;

FIGURE 3 is a circuit diagram of an alternative switching arrangement which can form part of an alternative embodiment of the invention.

FIGURE 4 is an alternative typical Long Sleep Life Supertacs Cellphone block diagram;

FIGURE 5 is a typical Supertacs UHF/VHF Network diagram.

Referring initially to the drawings a conventional cellular telephone 1 is indicated by a simple block. The cellular telephone itself does not require a description for a full understanding of the present invention, but the cellular telephone is provided with monitoring electronic apparatus to enable the cellular telephone to communicate, via a base station, with the electronic mobile exchange or mobile switching station of the cellular communication system in order to register, monitor and respond to control commands. The cellular telephone is also provided with the usual circuits and facilities to enable the user of the telephone to make and receive calls.

At this stage it should be mentioned that the cellular telephone is provided with a reset button 2 which can be pressed, by operator of the cellular telephone, at the end of a call. In alternative types of cellular telephone different arrangements are provided, such as a magnetic rest for a handpiece of the cellular telephone, but means are always provided which are actuated at the end of a call on a cellular telephone to restore the cellular telephone to the idle condition.

In the present invention, the cellular telephone is associated with a switching circuit 3 which can effectively be used to switch on the main cellular telephone apparatus. Thus the cellular telephone is, in use, completely switched off until it is activated by the switching circuit 3.

The switching circuit 3, which is a relay switching circuit, is activated in response to a specific signal received by a low frequency narrow band signal receiving means 4. The low frequency narrow band signal receiving means 4 may comprise a circuit equivalent to a conventional digital radio pager which responds to a low frequency signal, typically of 150 MHz. Thus, such a signal receiving means may readily be fabricated utilising microchip technology, and consequently the narrow band signal receiving means 4 may be permanently activated whilst only consuming a relatively small amount of power. The amount of power consumption may be further reduced by cyclically switching the signal receiving means 4 on and off in a regular manner, so that during any period of time the receiving means 4 is only activated for relatively brief periods which are spaced apart.

In the present invention, when the appropriate allocated signal is received by the low frequency signal receiving circuit 4, instead of actuating a buzzer or bleeper, as in the case of a conventional radio pager, a signal is passed, over the lead 5, to the relay switching arrangement 3. When it receives a signal over the lead 5, even if it is a transitory signal, the switching arrangement 3 switches on the main battery supply to the rest of the cellular telephone apparatus. The cellular telephone apparatus is thus fully activated and can register its presence, via the nearest base station, to the electronic mobile exchange or mobile switching centre. The cellular telephone may receive appropriate command signals, and an audio channel may then be opened to enable the cellular telephone to receive a call.

It will thus be understood that when a call is to be made to a particular cellular telephone initially the cellular telephone will receive a low frequency narrow band signal to be received by the receiving means 4, and this will serve to activate the main circuits of the cellular telephone. Subsequently, when the cellular telephone has been activated, the cellular telephone will receive the conventional signals to establish the required communication so that the person using the cellular telephone can receive the call.

When a call is accepted, and a conversation is in progress, an appropriate signal may be provided, from the cellular telephone 1, via the lead 7, to the switching arrangement 3, to maintain the switching arrangement 3 in such a condition that the main battery is kept connected to the rest of the cellular telephone apparatus. Thus the switching arrangement 3 can be considered to be a latching circuit.

Additionally, the switching arrangement 3 may be provided with a time delay arrangement so that, whenever the switching arrangement 3 is activated in response to a signal from the receiving means 4 over the lead 5, the switching arrangement will remain in a condition in which it maintains the battery supply to the cellular telephone apparatus for at least a predetermined period of time which may, for example, be ten minutes. This should be quite sufficient to enable the user of the cellular telephone apparatus to accept the call, or if the call is lost due to interference or for some other unforeseen cause, to accept a second attempt made by the same caller.

It will be understood that the mobile switching centre or electronic mobile exchange will be so arranged, and will be provided with such software, that when it is desired to put a call through to a cellular telephone, initially a command is forwarded to a low frequency transmitter which transmits a digital signal to be received by the appropriate receiving means 4, and after a predetermined time delay, the normal high frequency signals will be transmitted to the cellular telephone. It is envisaged that the existing radio paging transmitters may be utilised to transmit the initial low frequency signal, although it may be preferred to install additional low frequency transmitters to perform this function. These low frequency transmitters need not be located at the existing base stations, but may be so located if desired.

When a call made on a cellular telephone is terminated, a button such as the reset button 2 may be pressed. In the described embodiment, when the reset button 2 is pressed the signal transmitted over the lead 7 to the switching arrangement 3 is terminated and this acts to alter the state of the switching arrangement 3 such that a signal is no longer provided to the cellular telephone along the lead 6. The main circuits, including the receiver and transmitter, of the cellular telephone is thus effectively switched off, saving the batteries of the cellular telephone.

The cellular telephone may, of course, be provided with an override button 8 which serves to activate an appropriate bypass switch within the cellular telephone to ensure that the cellular telephone is always switched on and is thus always able to receive conventional high frequency broadband signals, should the person using the cellular telephone so desire. Also, of course, the cellular telephone will be provided with appropriate controls to enable the cellular telephone to be activated at will when it is desired to make a call from the cellular telephone.

Referring now to Figure 2 one example of the switching circuit 3 is illustrated. It can be seen that the lead 5 is connected, through the solenoid coil 9 of a normally open solenoid operated relay switch 10 to earth, via lead 11. The relay, when closed, serves to connect a positive rail 12, to a terminal 13 which is connected to the line 6 which extends to the cellular telephone 1. The terminal 13 is also connected, by means of the contacts of a normally closed solenoid operated relay 14 to the lead 5 and thus to the input of the coil 9 of the solenoid of the relay 10.

If the circuit is in the condition illustrated in Figure 2, when the circuit 4 receives the low frequency signal a pulse is passed through the lead 5 which energizes the coil 9, thus closing the relay 10. Current from the positive rail 12 is thus fed to the terminal 13. The current from the terminal 13 can then pass through the lead 6 to activate the switching arrangement within the cellular telephone 1. Also current from the terminal 13 flows through the normally closed contacts of the relay 14 to the coil 9 of the relay 10, thus ensuring that the relay 10 is kept closed, even when the pulse is no longer received from the low frequency circuit.

The lead 7 is connected through the coil 15 of the normally closed relay 14 to earth and the arrangement is such that when the reset button 8 is pressed on the cellular telephone a pulse passes through the lead 7, and through the coil 15, thus opening the normally closed relay 14. As the normally closed relay 14 opens the circuit from the positive rail 12, through the closed contacts of the relay 10, the terminal 13 and the coil 9 of the relay 10 is broken. Thus the relay 10 re-opens, thus breaking the contact between the rail 12 and the terminal 13. Thus the cellular telephone is then de-activated, and returned to the preliminary or idle condition.

Figure 3 illustrates a circuit which can be used in place of the circuit of Figure 2, the circuit of Figure 3 being a logic circuit. The lead 5 is connected to one input of an OR gate 15. The output 16 of the OR gate 15 is connected to the lead 6 and is also connected to one input of a NAND gate 17 by means of the lead 18. The other input of the NAND gate 17 is connected to the lead 7. The output 19 of the NAND gate 17 is connected to the other input of the OR gate 15. When a signal is received by the low frequency circuit, a logic one appears on the lead 5 which is connected to the OR gate 15. This causes a logic one to appear on the lead 16 and thus on the lead 6. Since a logic one appears on the lead 16 the logic one also appears on the lead 18 and thus one input of the NAND gate 17 receives a logic one, thus causing the logic one to be present on the output 19 which is connected to the OR gate 15. The OR gate thus remains activated even if the initial signal provided on the lead 5 terminates. However, when the reset button 8 is pressed on the cellular telephone a second logic one is supplied, through the lead 7, to the NAND gate 17, thus causing that gate to switch off, thus causing the OR gate 15 to switch off, thus terminating the logic one present on the lead 6.

The switching circuit 3 may, of course, be constructed in many other ways whilst providing the desired switching effect.

It is to be appreciated, therefore, that when the apparatus of the present invention is utilised the low frequency circuit is normally active, and since this is a low frequency circuit, which embodies integrated micro-circuitry, it is possible to run the circuit for a long period of time with only a minimum power consumption. When the low frequency circuit receives an appropriate signal, the main circuits, including the receiver and transmitter, of the cellular telephone are activated, the cellular telephone can then receive a conventional signal. Thus the low frequency circuit provides only a low current drain while the apparatus is in the quiescent or idle state, and the cellular telephone may operate in the manner of a conventional cellular telephone when it has been activated. Thus only a small battery may be needed to power the main circuits of the cellular telephone, since these circuits will only consume power when a call is in progress.

TYPICAL "LONG SLEEP LIFE" BLOCK DIAGRAM

Figure 4 is a typical block diagram for a Long Sleep Life Supertacs cellphone apparatus. In this diagram, the rechargeable cells B1, supplying the main UHF duplex cellphone circuits, C1, via the manual switch, S2, is also used to provide power for the VHF page receiver circuits C2 (and the control circuits C3, C4, and S3), via the manual switch S1. If the Supertacs Subscriber does not wish to be disturbed at all, both manual switches S1, and S2 are switched off. To select the Long Sleep Life mode, the manual switch S2 would be kept off, and only the manual switch S1 switched on.

CALL RECEPTION: Advantageously and conveniently, each subscriber using this Long Sleep Life apparatus is provided with a telephone number containing a recognizable code or cue, eg. 0837 517 689. In this typical example, the fourth digit 7 is the code or cue for the MSC software instructions to recognize that the subscriber is a SUPER SUBSCRIBER (or typically a SUPERTACS SUBSCRIBER). On recognition of this digital code, the MSC software is provided with instructions in its memory, to immediately generate a specific VHF coded page (for that Subscriber's apparatus) through the VHF paging network provided, and after a predetermined time delay, typically 3 secs, then generate the conventional UHF page/control signals as per the existing conventional (typical TACS) signalling sequences.

The VHF Page Receiving Circuit C2, having received the coded signal from the VHF transmitter (see figure 3), and after identification through its decoding circuits, feeds a momentary transducer drive signal to the three input "OR" LOGIC GATE IC, C3, which in turn feeds and starts up the timer, C4, which feeds and turns on the solid state relay switch, S3, and keeps it held closed for a predetermined time - typically 50 secs. It will be noticed from the diagram that the solid state relay switch, S3, bypasses the cellphone circuit manual switch, S2, and hence energizes the UHF duplex cellphone circuits, C1. This causes the cellphone to go through the (typical TACS) "power up" signalling sequence, and after receipt of the UHF page and further (typical TACS) control signalling sequences, the Subscriber is connected to the calling party, and the ringing tone, followed by acceptance of the call and conversation may ensue.

CALL INITIATION: To initiate a call, the Supertacs Subscriber pushes the spring biased manual push button, P1. This causes a momentary voltage to be fed into the three input "OR" GATE IC, C3, from the battery, B1, which in turn starts up the 50 second timer, C4, which closes the solid state relay, S3, and provides power to the UHF Duplex cellphone circuits, C1. After the apparatus registers (as per the typical TACS specification), the Subscriber may proceed to dial and make the call in the manner of typical existing cellular telephone systems. As long as activity is taking place within the UHF duplex cellphone circuit, C1, the three input "OR" GATE IC, C3, receives an "in use" signal from the UHF duplex cellphone circuit, C1, which in turn keeps the 50 second timer, C4, recycling and the solid state relay switch, S3, latched on, and hence the battery, B1, power supply maintained to the UHF cellphone circuit, C1.

CLEAR DOWN: As soon as activity within the UHF duplex cellphone circuits, C1, ceases, (either due to the conversation ending, and/or the call being terminated, and/or if there is no further signal received by the three input "OR" GATE IC, C3), the 50 second timer, C4, ceases to recycle any further, and at the end of its predetermined time (typically 50 secs), the solid state relay switch, S3, is deactivated, thereby disconnecting the battery, B1, from the heavy current consuming UHF cellphone circuits, C1, thus saving battery energy. The circuit is now in the Long Sleep Life mode. The only current consumption is that of the VHF receiver circuit, C2, and the control circuits comprising of the three input "OR" GATE IC, C3, the 50 second timer, C4, and the solid state relay switch, S3, all of which have minimal current consumption.

CONVENTIONAL UHF MODE OPTION: If the manual switch, S2, is closed (and S1 preferably open), the apparatus is not in the Long Sleep Life mode. This is an option which the subscriber may select to use:-

- if a call is expected and quicker response required, or
- if it is suspected that the VHF paging Network is faulty, or
- if the "Super" VHF paging Network is not yet operational.

However, in this mode, battery life is limited to that of the conventional existing cellular system.

AUTOMATIC NEW ZONE RE-REGISTRATION

It is an additional embodiment of this invention to automatically switch on the duplex UHF cellular circuits of the long sleep life cellphone apparatus to reregister its presence, identity and cell area location every time the apparatus is moved from one zone of cellular base stations to another zone in order to obviate the possibility of communication being lost as well as reduce the time it takes for a search.

It is a typical practice with existing UHF duplex cellular networks when paging a UHF duplex cellular telephone to send a UHF page simultaneously through a cluster or zone of cellular base stations. In any specific country there may be a plurality of such zones. For example, each of the 2 networks serving Britain, may have typically five such zones.

In this additional embodiment of this invention, each zone shall be covered by one or more VHF radio paging transmitters typically activated simultaneously by a zone VHF paging centre. The software on each zonal paging centre is provided with instructions to transmit a coded identity number either typically at the beginning (or end) of every coded paging number transmitted and/or periodically as an identification code. The software of the Central Processing Unit (CPU) of the VHF digital paging circuits of the Long Sleep Life Cellphone Apparatus described in this Patent, is provided with instructions to compare and store in its memory, the identity number of the VHF paging zone within which it is located. If there is no change between the paging zone identity and the zone identity numbers being received, no further activity takes place. If, however, the paging zone identity number differs from the one stored in its memory, instructions in the said CPU software shall immediately activate the transducer drive signal (see figure 4) which in turn will activate the solid state relay (via the level shifting interface, via the 50 second timer) to switch on the cellphone for a predetermined period - typically 50 seconds, sufficient time for the duplex UHF cellular circuits to switch on and re-register the cellphone's presence, identity and location. The fresh VHF paging zone identity number is now stored in the memory of the VHF paging receiver circuits and no further activity will ensue until the apparatus is moved to a new zone, and a new zone identity number received.

Thus it is evident from the above, that after a call is received, as per the typical Supertacs Signalling Sequences shown, it is only necessary to page (both on the VHF and UHF) in the zone the apparatus was last known to have registered, and there is no need for nationwide VHF and/or UHF paging.

It is thus possible to provide a cellular telephone that is truly pocket sized, that incorporates only a relatively small battery, that will operate in the normal way for a substantial period of time before the battery needs replacing, recharging, and/or boosting.

CLAIMS

1. A cellular radio telephone apparatus, said apparatus comprising means to establish connection with and receive electric power from a battery, VHF radio receiver circuit/control circuits, and duplex UHF cellular radio telephone electronic circuits driven by said electric power adapted to receive, monitor, process and transmit cellular telephone signals, there being a normally open controlled relay switch between the battery and said duplex UHF cellular radio telephone electronic circuits, and means to close said relay switch in response to a specific VHF radio transmitted signal in order to activate said duplex UHF cellular radio telephone electronic circuits.
2. An apparatus according to claim 1 wherein said means to activate/control the relay switch comprise a radio receiver adapted to receive a digitally coded VHF radio signal of a predetermined frequency, and a decoder circuit adapted to decode the signal and to respond to a specific digitally coded signal.
3. An apparatus according to claim 2 wherein the radio receiver is adapted to receive a radio signal having a frequency not below 138 MHz and not above 174 MHz.
4. An apparatus according to claim 2 or 3 wherein the radio receiver is adapted to receive a radio signal of a predetermined frequency having a bandwidth of 25 KHz.
5. An apparatus according to claim 2, 3 or 4 wherein said radio signal has a frequency of substantially 150 MHz.
6. An apparatus according to any one of the preceding claims wherein means are provided which, when said relay switch has been closed in response to said specific radio transmitted signal, maintain the relay switch in the closed condition at least until a predetermined time has elapsed.
7. An apparatus according to any one of the preceding claims wherein the means to operate the relay switch are such that the relay switch is maintained closed until a predetermined signal is provided.

8. An apparatus according to claim 7 wherein said means provided to generate said predetermined signal are adapted to be deactivated at the termination of a call received by the apparatus.

9. An apparatus according to any one of the preceding claims wherein the means to activate the normally off relay switch comprise a latching circuit adapted to be latched in a predetermined condition in response to said specific transmitted signal.

10. An apparatus according to claim 9, wherein said latching circuit incorporates a relay adapted to be closed in response to said specific transmitted signal, the relay closing a current path which maintains the relay in a closed condition, said current path incorporating a closed second relay, said closed second relay being adapted to open in response to said predetermined signal to release the latching circuit.

11. An apparatus according to claim 9 wherein said latching circuit incorporates an OR gate adapted to be provided with a pulse in response to said specific transmitted signal, the output of the OR gate being connected to one input of a NAND gate, the output of the NAND gate being connected to the other input of the OR gate, the output of the OR gate being connected to a switching arrangement adapted to activate the normally inactive receiver and transmitter, a lead being connected to the other input of the NAND gate adapted to provide a said predetermined signal to the NAND gate when it is desired to deactivate the high frequency receiver.

12. A cellular telephone apparatus substantially as herein described with reference to and as shown in Figure 1 of the accompanying drawings.

13. A cellular telephone apparatus substantially as herein described with reference to and as shown in Figure 1 of the accompanying drawings as modified by Figure 2.

14. A cellular telephone apparatus substantially as herein described with reference to and as shown in Figure 1 of the accompanying drawings as modified by Figure 3.

15. A cellular telecommunication system comprising a plurality of cellular telephones according to any one of claims 1 to 14 and a plurality of base stations, each base station comprising means to transmit signals to and receive signals from the said electronic circuits of the cellular telephone, the system further including means to transmit said specific radio signals to the cellular telephones.

16. A cellular telephone system according to claim 15 wherein each base station is provided with means to transmit said specific radio signals.

17. A cellular telephone system according to claim 15 wherein the system comprises a mobile switching centre and/or an electronic mobile exchange adapted to control the transmission of said specific signals and being adapted to control the transmission of additional signals to the said electronic circuits of a cellular telephone, the arrangement being such that the predetermined signal is transmitted a predetermined period of time before said additional signals to said electronic circuits are transmitted.

18. A cellular telephone system according to any one of claims 15 to 17 wherein the means to transmit said specific signals transmit the signals at a frequency not below 138 MHz and not above 174 MHz.

19. A cellular telephone apparatus substantially as herein described, with reference to and as shown in figure 4 and figure 5.

20. A cellular telephone system according to any one of the preceding claims wherein automatic switching on of the duplex UHF cellular circuits is provided for in the manner described in detail in this specification whenever the apparatus is moved from one UHF cellular zone to another UHF cellular zone in order to achieve automatic re-registration of the apparatus.

21. A cellular telephone system according to any one of the preceding claims, wherein an additional manual "On/Off" bypass switch is provided to short circuit the contacts of the said normally open control relay switch.

22. Any novel features or combination of features disclosed herein.

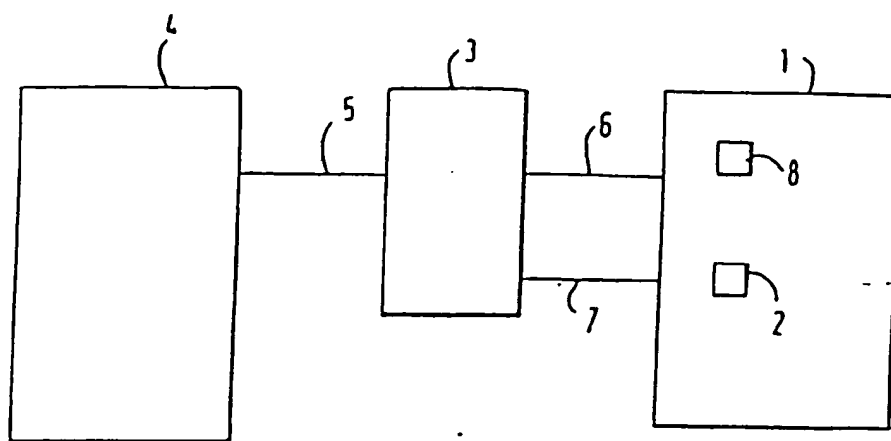


FIG 1 /

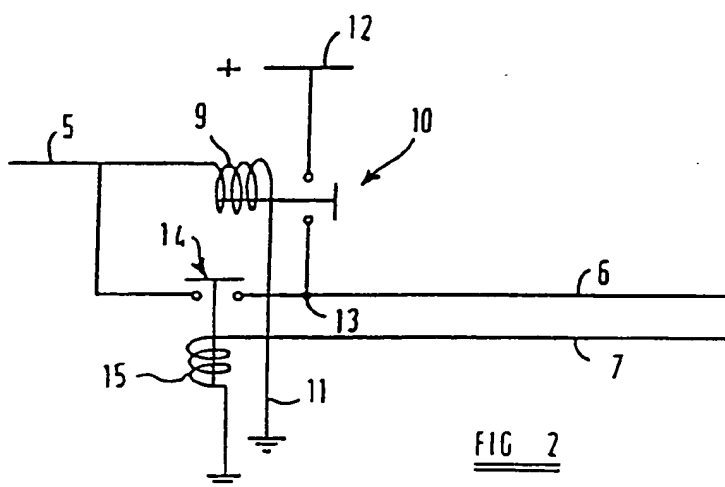


FIG 2

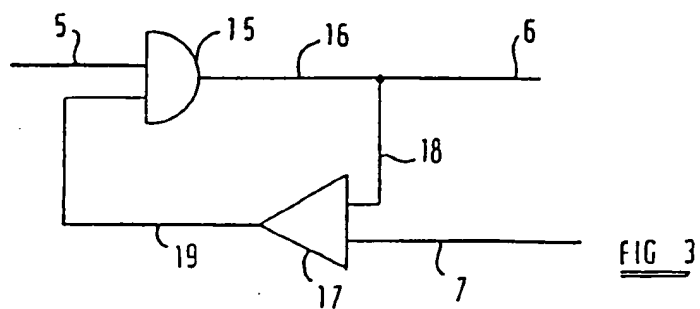


FIG 3

2/3

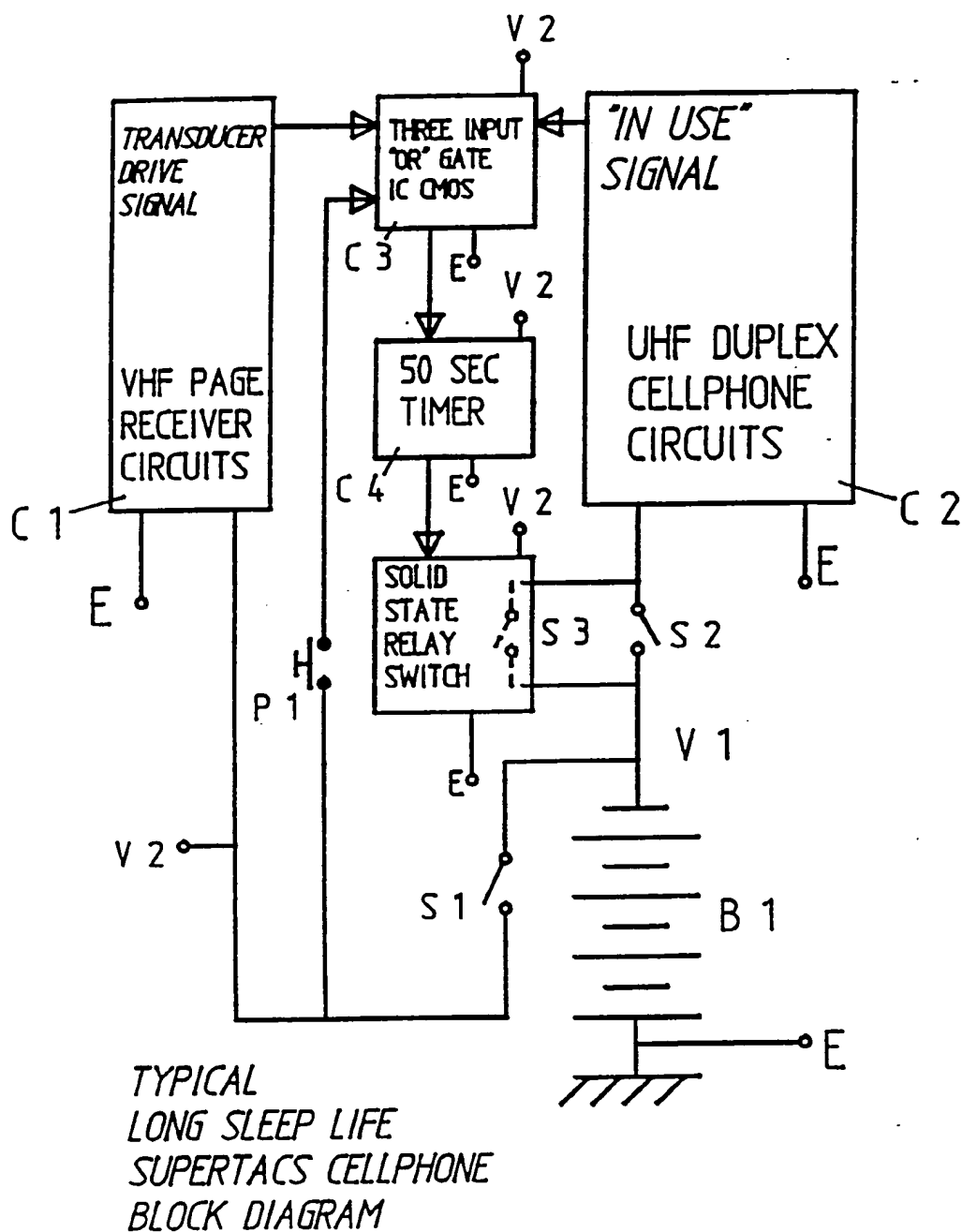
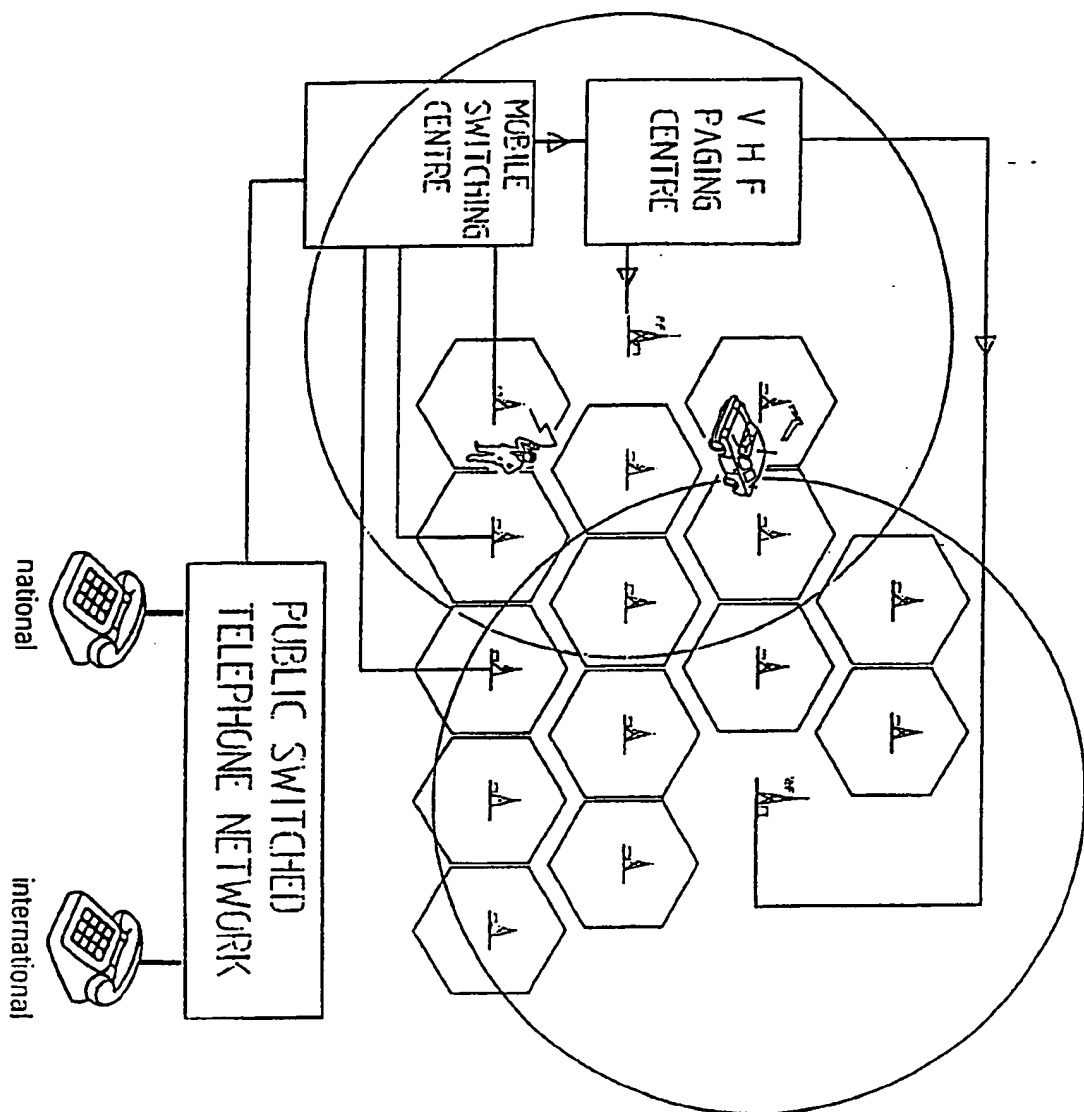


FIGURE 4



TYPICAL
SUPERTACS
UHF/VHF
NETWORK

FIG 5

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 88/00134

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁸ According to International Patent Classification (IPC) or to both National Classification and IPC IPC ⁴ : H 04 Q 7/04																	
II. FIELDS SEARCHED <div style="text-align: right; font-size: small;">Minimum Documentation Searched ⁷</div> <table style="width: 100%; border: none;"> <tr> <td style="width: 30%; border-bottom: 1px solid black; font-size: small;">Classification System</td> <td style="border-bottom: 1px solid black; font-size: small;">Classification Symbols</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">IPC⁴</td> <td style="border: 1px solid black; padding: 5px;">H 04 Q; H 04 B</td> </tr> </table> <div style="text-align: center; font-size: x-small; margin-top: 5px;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched ⁶</div>			Classification System	Classification Symbols	IPC ⁴	H 04 Q; H 04 B											
Classification System	Classification Symbols																
IPC ⁴	H 04 Q; H 04 B																
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹ <table border="1" style="width: 100%; border-collapse: collapse; font-size: x-small;"> <tr> <th style="width: 10%;">Category ^a</th> <th style="width: 70%;">Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²</th> <th style="width: 20%;">Relevant to Claim No. ¹³</th> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td>Patent Abstracts of Japan, volume 10, no. 236 (E-428)(2292), 15 August 1986, & JP, A, 6167336 (MATSUSHITA ELECTRIC IND. CO. LTD) 7 April 1986 --</td> <td style="text-align: center; vertical-align: top;">1,2</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td>EP, A, 0011063 (INT. MOBILE MACHINES CORP.) 28 May 1980 see page 3, lines 16-36; page 5, line 1 - page 6, line 7; page 7, line 25 - page 8, line 10; page 12, line 27 - page 13, line 10; claim 1 --</td> <td style="text-align: center; vertical-align: top;">1,2,4,6-11</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td>DE, A, 2209134 (TEKADE) 1 March 1973 see page 1, lines 1-10; page 1, line 30 - page 4, line 17 --</td> <td style="text-align: center; vertical-align: top;">1,2,6-11</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td>DE, B, 1006474 (LORENZ AG) 18 April 1957 see column 2, lines 40-51; column 3, line 37 - column 4, line 5; column 5, line 1 - column 6, line 19 -- ./.</td> <td style="text-align: center; vertical-align: top;">1,2,6-10</td> </tr> </table>			Category ^a	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	A	Patent Abstracts of Japan, volume 10, no. 236 (E-428)(2292), 15 August 1986, & JP, A, 6167336 (MATSUSHITA ELECTRIC IND. CO. LTD) 7 April 1986 --	1,2	A	EP, A, 0011063 (INT. MOBILE MACHINES CORP.) 28 May 1980 see page 3, lines 16-36; page 5, line 1 - page 6, line 7; page 7, line 25 - page 8, line 10; page 12, line 27 - page 13, line 10; claim 1 --	1,2,4,6-11	A	DE, A, 2209134 (TEKADE) 1 March 1973 see page 1, lines 1-10; page 1, line 30 - page 4, line 17 --	1,2,6-11	A	DE, B, 1006474 (LORENZ AG) 18 April 1957 see column 2, lines 40-51; column 3, line 37 - column 4, line 5; column 5, line 1 - column 6, line 19 -- ./.	1,2,6-10
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<div style="display: flex; justify-content: space-between; font-size: x-small;"> <div style="width: 45%;"> <p>^a Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"G" document member of the same patent family</p> </div> </div>																	
IV. CERTIFICATION <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border-bottom: 1px solid black; font-size: small;">Date of the Actual Completion of the International Search</td> <td style="width: 50%; border-bottom: 1px solid black; font-size: small;">Date of Mailing of this International Search Report</td> </tr> <tr> <td style="text-align: center; padding: 5px;">17th May 1988</td> <td style="text-align: center; padding: 5px;">15 JUN 1988</td> </tr> <tr> <td style="border-bottom: 1px solid black; font-size: small;">International Searching Authority</td> <td style="border-bottom: 1px solid black; font-size: small;">Signature of Authorizing Officer</td> </tr> <tr> <td style="text-align: center; padding: 5px;">EUROPEAN PATENT OFFICE</td> <td style="text-align: center; padding: 5px;"> P.C.G. VAN DER PUTTEN </td> </tr> </table>			Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	17th May 1988	15 JUN 1988	International Searching Authority	Signature of Authorizing Officer	EUROPEAN PATENT OFFICE	 P.C.G. VAN DER PUTTEN							
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International Searching Authority	Signature of Authorizing Officer																
EUROPEAN PATENT OFFICE	 P.C.G. VAN DER PUTTEN																

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	International Conference Mobile Radio Systems and Techniques, 10-13 September 1984, (York, GB), R.C. French: "A high technology VHF radio paging receiver", pages 11-15 see the whole document --	1-5
A	EP, A, 0186004 (SIEMENS) 2 July 1986 see the whole document --	1-3,5
A	EP, A, 0193316 (NEC) 3 September 1986 see page 2, line 13 - page 3, line 20; page 4, line 25 - page 6, line 19; page 12, line 13 - page 14, line 20 --	1,2,6-11
X,P	EP, A, 0212761 (PHILIPS) 4 March 1987 see the whole document -----	1,15-17,20

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

GB 8800134

SA 20939

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 06/06/88. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A- 0011063	28-05-80	None	
DE-A- 2209134	01-03-73	None	
DE-B- 1006474		None	
EP-A- 0186004	02-07-86	DE-A- 3444989	12-06-86
EP-A- 0193316	03-09-86	AU-A- 5369186	21-08-86
		JP-A- 61189738	23-08-86
		US-A- 4661972	28-04-87
		CA-A- 1231385	12-01-88
EP-A- 0212761	04-03-87	AU-A- 6168186	05-03-87
		JP-A- 62051840	06-03-87
		GB-A- 2179823	11-03-87